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# Changes in the Distribution of Workers' Hourly Wages Between 1979 and 2009

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# Changes in the Distribution of Workers' Hourly Wages Between 1979 and 2009

## **Abstract**

[Excerpt] This Congressional Budget Office (CBO) study, which was prepared at the request of the chairman and former ranking member of the Senate Committee on Finance, documents changes in the level and distribution of hourly wages received by workers in the United States between 1979 and 2009. It also reviews the leading explanations for changes in the supply of, and demand for, workers with different sets of skills as well as the role of labor market institutions in affecting wages. In keeping with CBO's mandate to provide objective, impartial analysis, this study does not make any recommendations.

## **Keywords**

Congressional Budget Office, wages, labor market, labor supply, labor demand, wage distribution

## **Comments**

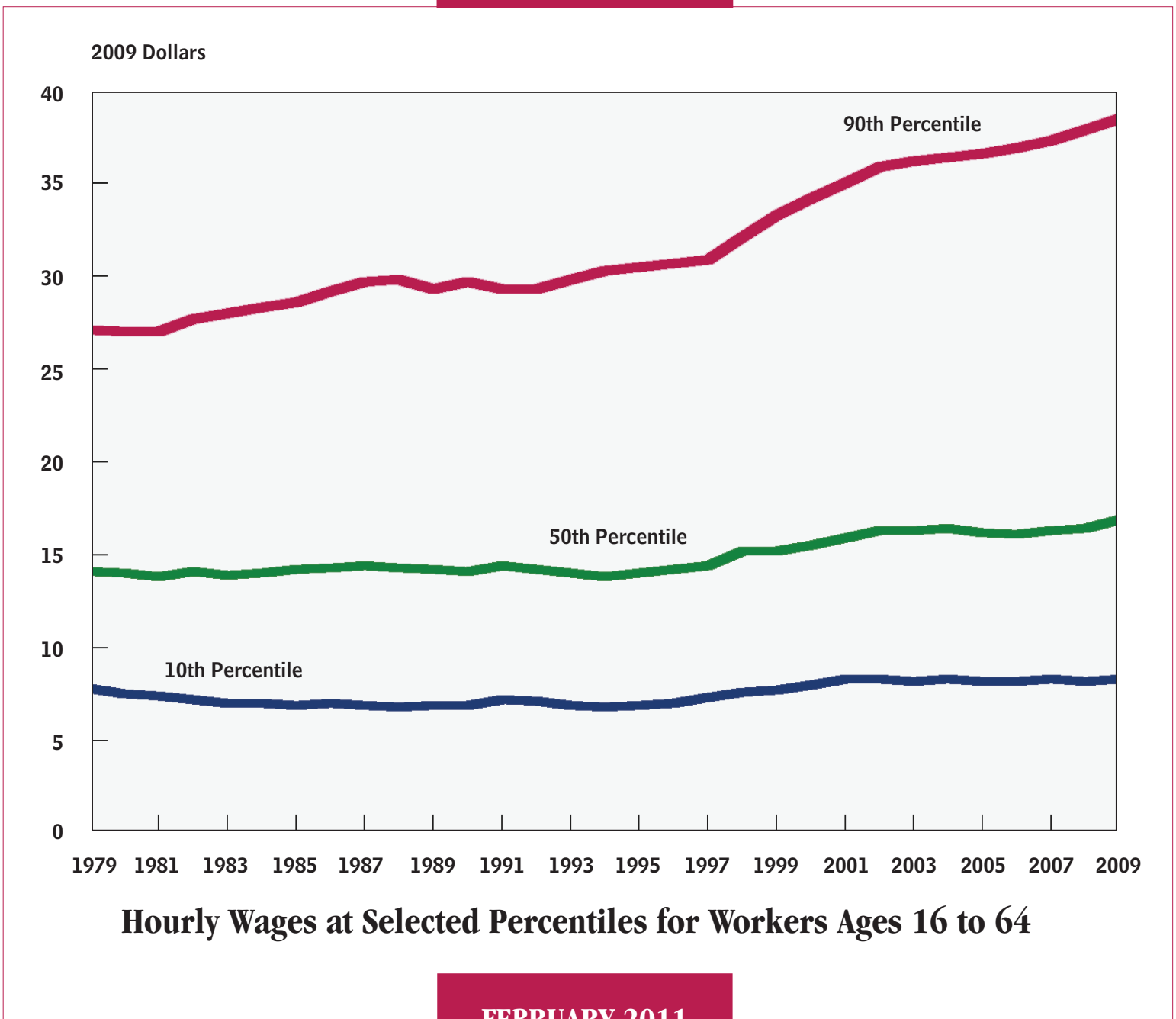
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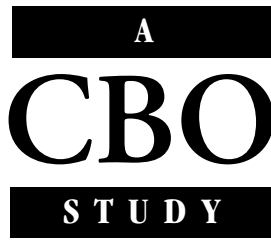
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# CBO

## Changes in the Distribution of Workers' Hourly Wages Between 1979 and 2009







# **Changes in the Distribution of Workers’ Hourly Wages Between 1979 and 2009**

February 2011



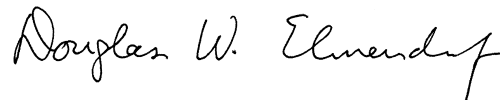


## Preface

**T**his Congressional Budget Office (CBO) study, which was prepared at the request of the chairman and former ranking member of the Senate Committee on Finance, documents changes in the level and distribution of hourly wages received by workers in the United States between 1979 and 2009. It also reviews the leading explanations for changes in the supply of, and demand for, workers with different sets of skills as well as the role of labor market institutions in affecting wages. In keeping with CBO's mandate to provide objective, impartial analysis, this study does not make any recommendations. A related CBO study published in October 2009 analyzed trends in the distribution of annual earnings (*Changes in the Distribution of Workers' Annual Earnings Between 1979 and 2007*); a forthcoming CBO study will examine trends in the distribution of household income between 1979 and 2007.

Nabeel Alsalam of CBO's Health and Human Resources Division wrote the study under the guidance of Greg Acs and Bruce Vavrichek. Sarah Axeen provided research assistance. Helpful comments came from Will Carrington, Molly Dahl, Naomi Griffin, Jonathan Schwabish, and Charles Whalen, all of CBO; from Melissa Kearney of the University of Maryland; Marvin Kosters of the American Enterprise Institute; and Frank Levy of the Massachusetts Institute of Technology. (The assistance of external reviewers implies no responsibility for the final product, which rests solely with CBO.)

Christine Bogusz edited the study, and Kate Kelly proofread it. Maureen Costantino designed the cover and prepared the report for publication, with assistance from Jeanine Rees. Monte Ruffin produced the initial copies, and Linda Schimmel coordinated the print distribution. The study is available on CBO's Web site ([www.cbo.gov](http://www.cbo.gov)).



Douglas W. Elmendorf  
Director

February 2011







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# Changes in the Distribution of Workers' Hourly Wages Between 1979 and 2009

## Summary and Introduction

Wages are a key component of the overall economic well-being of individuals and families. Hourly wages and hours worked determine an individual's earnings, and for most nonelderly adults, earnings constitute the bulk of their family's income. This Congressional Budget Office (CBO) study documents changes in the level and distribution of hourly wages in the United States between 1979 and 2009.<sup>1</sup> It also reviews the research literature on important factors that most likely underlie the observed trends in wages.

The wage rate (the wage per hour of work) received by workers in the middle of the wage distribution (the 50th percentile) increased by about 20 percent over the 1979–2009 period after adjusting for inflation, reaching about \$17 per hour in 2009. The dispersion of wages—the gap between wages at the top and bottom of the distribution—also increased over that period, but the pattern of changes at the top and bottom differed. For men and women alike, the gap between the wage rates received by high-wage (90th percentile) and middle-wage workers expanded throughout the 30-year period; the wage rates of high-wage women grew especially rapidly. In contrast, the gap between the wage rates received by low-wage (10th percentile) and middle-wage workers widened for both men and women early in the 1980s but has remained stable for the past 20 years.<sup>2</sup>

1. This analysis is not restricted to workers paid by the hour. For workers who are not paid by the hour, CBO estimated their effective hourly wage as their usual weekly earnings divided by their usual hours worked per week.
2. See Congressional Budget Office, *Changes in Low-Wage Labor Markets Between 1979 and 2005* (December 2006), for an earlier analysis of the changes in the lower half of the wage distribution.

Wages are affected by market forces (the level and distribution of skills supplied by workers and employers' demand for those skills) and institutional factors (such as minimum-wage laws and changes in the share of the workforce represented by unions).<sup>3</sup> Given the complex pattern of changes in the wage distribution during the past 30 years, it is not surprising that no single explanation can account for the entire pattern.

In the category of market forces, innovations in information and computing technology in the 1990s and 2000s generated growing demand for skilled labor, particularly for highly educated workers, that outpaced growth in the supply of highly skilled, highly educated workers; that differential probably played a large role in the observed changes in the wage distribution. Shifts in international trade might also have contributed to increasing relative demand for skilled labor, as imports from low-wage countries substituted for some domestic production and employment; however, research on the significance of that effect is inconclusive. In addition, a rising number of foreign-born people in the workforce affected the relative supply of workers with different amounts of education, but that shift appears to have had only a modest effect on the distribution of wages.

3. More precisely, hourly compensation, which is the total cost to employers of an hour of a worker's labor, is determined by those factors. Compensation includes cash wages—the focus of this study—plus the value of nonwage benefits such as paid leave, health insurance, and retirement plans provided by the employer. About 70 percent of compensation is currently in the form of cash wages; that share has declined somewhat over time. See Brooks Pierce, "Recent Trends in Compensation Dispersion," in Katharine Abraham, James Spletzer, and Michael Harper, eds., *Labor and the New Economy* (Chicago: University of Chicago Press, 2010).

Turning to institutional factors, the decreasing real (inflation-adjusted) value of the federal minimum wage probably increased wage dispersion in the bottom half of the wage distribution in the 1980s. Moreover, declining unionization rates contributed to increasing dispersion in the upper half of the wage distribution for men over that same decade. Neither of those factors is a plausible explanation for the changes in the wage distribution in the 1990s and 2000s, however.

Although this study focuses on hourly wages, changes in the level and distribution of hourly compensation, which includes both wages and fringe benefits, are also important. Unfortunately, data on hourly compensation are more limited than data on hourly wages. Based on the data that are available, the dispersion in hourly compensation in the upper half of the distribution was similar to the dispersion of wages, on average, between 1987 and 2007. In the lower half of the distribution, the dispersion of hourly compensation was somewhat greater than that for wages, on average, during the same period. Nevertheless, for both the upper and the lower halves of the distribution of compensation, the changes in dispersion over those two decades were similar to the changes in the dispersion of wages (see Box 1).

### Changes in Wages Over Time

Although the distribution of wages may be described in many ways, the most straightforward approach is to compare wage rates at different parts of the distribution. This study documents the extent to which hourly wages differ between the middle and the upper end of the wage distribution (the 50th and 90th percentiles, respectively) and between the lower end and the middle of the wage distribution (the 10th and 50th percentiles)—in 1979, 2009, and the intervening years. (For additional information on the measurement of wage distributions, see Box 2.) The data on wages used for this analysis are drawn from the Census Bureau's monthly Current Population Survey. (For more information on those data, see Appendix A.)<sup>4</sup>

To better demonstrate wage patterns, this study examines the distribution of wages separately for men and women. Over the 30-year period that CBO considered, the participation rate of men ages 16 to 64 in the labor force fell from 86 percent to 80 percent, whereas the participation rate of women ages 16 to 64 in the labor force increased from 59 percent to 69 percent. Although

changes in the characteristics and composition of the workforce influenced the wages of men and women alike, the impact of those changes was probably greater on women because the distribution of workers across occupations, their educational attainment, and their hours of work changed more substantially for women than they did for men. For that reason, changes in men's wages may provide a better gauge of how the market valuation of skills changed between 1979 and 2009.

### The Level and Distribution of Wage Rates

Among working men, the median wage in 2009 was \$18.50 (see Table 1 on page 5).<sup>5</sup> That wage translates to about \$37,000 annually for a full-time, full-year worker. Toward the upper end of the distribution, the 90th percentile wage was \$43.00 (\$86,000 annually); toward the lower end of the distribution, the 10th percentile wage

4. The data used for this analysis are not appropriate for an analysis of the wages of very high earners—chief executive officers, sports and entertainment stars, financial market traders, and so on—because there are so few of them in the survey. Moreover, to protect the privacy of the relatively small number of very high-wage workers who are included, the Census Bureau does not report an individual's earnings if they exceed a certain level but instead reports only the fact that earnings are above that level. (For information about very high earners, see Appendix B.)
5. The recent recession substantially affected workers' earnings, through lost hours, lost jobs, and increased difficulty in finding work. Among those working, however, the recession did not cause a discernable break in the trends in hourly wages observed over the 1979–2009 period. Between 2007 (the last prerecession year) and 2009, the inflation-adjusted median hourly wage for men increased by almost 4 percent, rising from \$17.80 to \$18.50. Wage rates at the 90th and 10th percentiles also registered increases during that period. The impact of the recession on the wage distribution depends on many factors. For example, if those who lose jobs are disproportionately lower-wage workers, then the median wage (and wages at any given point in the distribution) among those who retain jobs will be higher than before the recession. That type of change occurs commonly during economic downturns. See Gary Solon, Robert Barsky, and Jonathon Parker, "Measuring the Cyclicalities of Real Wages: How Important Is Composition Bias?" *Quarterly Journal of Economics*, vol. 109, no. 1 (February 1994), pp. 1–25. Nevertheless, individuals who lost jobs during the recession may have to accept jobs that pay less than their old jobs. According to the Department of Labor, among workers who lost full-time jobs between 2007 and 2009 that they had held for over three years and were working in new full-time jobs in January 2010, more than half (55 percent) held jobs paying less than the ones they lost. See U.S. Department of Labor, "Worker Displacement: 2007–2009," USDL-10-1174 (news release, August 26, 2010), [www.bls.gov/news.release/pdf/disp.pdf](http://www.bls.gov/news.release/pdf/disp.pdf).

**Box 1.****Dispersion in Hourly Compensation**

Hourly compensation comprises hourly wages, non-wage benefits provided voluntarily by employers (such as employment-based health insurance, pensions, and paid leave), and certain legally required benefits (such as employers' contributions to Social Security and Medicare). In 2007, benefits represented 27 percent of compensation per hour, on average. Of that amount, 8 percentage points were for health insurance, 3 percentage points were for retirement benefits, 6 percentage points were for paid leave, and 1 percentage point was for other voluntarily provided benefits. Another 9 percentage points were for legally required benefits.<sup>1</sup>

The availability of data on hourly compensation is more limited than it is for hourly wages. However, from the data that are available, one can examine some of the differences in those two distributions.

For the average employee, benefit costs to employers as a fraction of total compensation rose from 25 percent to 27 percent between 1987 and 2007. Although

a smaller share of jobs provided health insurance benefits in 2007 than in 1987, the average cost of those benefits overall (including a cost of zero for jobs with no health insurance benefits) increased from 5 percent to 8 percent of compensation over the two decades.

Dispersion in compensation exceeds dispersion in wage rates. The difference in dispersion occurs primarily within the lower halves of those distributions. For example, in 2007, the 10th percentile of wages was 50 percent less than the median wage, but the 10th percentile of compensation was 56 percent less than the median compensation. That difference appears to result from the provision or nonprovision of benefits rather than from the value of those benefits that are provided. In particular, workers with wages near the median are more likely to receive health insurance and paid leave than workers with wages near the 10th percentile. There was less difference between dispersion in compensation and wages in the upper halves of those distributions. The 90th percentile of wages was 129 percent more than the median wage, while the 90th percentile of compensation was 133 percent more than the median compensation.

The changes in the dispersion of hourly compensation between 1987 and 2007 appear to be similar to the changes in the dispersion of hourly wages. The gap between the 90th and 50th percentiles of hourly compensation widened by about as much as the gap in wage rates at those percentiles. Dispersion in compensation in the bottom half of the distribution was about the same in 2007 as in 1987.

1. The statistics in this box (about compensation and wage dispersion) are taken from a study conducted at the Bureau of Labor Statistics; see Brooks Pierce, "Recent Trends in Compensation Dispersion," in Katharine Abraham, James Spletzer, and Michael Harper, eds., *Labor and the New Economy* (Chicago: University of Chicago Press, 2010). That study used data from the employment cost index (ECI), an establishment-based survey. The workers in those establishments are similar, for the most part, to the workers surveyed in the Current Population Survey, which the Congressional Budget Office used for this analysis of changes in the distribution of workers' hourly wages. The ECI, however, excludes agricultural workers, federal government workers, and private-household workers.

was \$8.90 (\$17,800 annually). Between 1979 and 2009, the median wage rate of men increased by about 8 percent after adjusting for inflation (see the left panel of Figure 1 on page 6). The 90th percentile wage rate increased much faster, by 40 percent, whereas the 10th percentile wage rate increased slightly more slowly, by 5 percent. (Wage levels are adjusted for inflation using

the personal consumption expenditure price index. See Appendix A for more information about that index.)

Among working women, the median wage in 2009 was \$15.10 (see Table 1). That wage translates to about \$30,200 annually for a full-time, full-year worker. The 90th percentile wage rate was \$33.50 (\$67,000 annually),

**Box 2.****Measuring Wage Dispersion**

This study focuses on three points of the wage distribution—the 10th percentile, the 50th percentile (or median), and the 90th percentile—to study changes in wage dispersion. If wages are ranked from lowest to highest, 10 percent of all hourly wages paid fall below the 10th percentile and 90 percent fall above it. As such, the 10th percentile wage represents nearly the bottom of the wage distribution. The 50th percentile wage divides the distribution of hourly wages in half and represents the middle of the wage distribution. The 90th percentile wage marks nearly the top of the wage distribution, separating the top 10 percent of wages from the bottom 90 percent.

In this study, wage dispersion in the top half of the wage distribution is measured by the extent to which the 90th percentile wage exceeds the 50th percentile wage. Likewise, wage dispersion in the bottom half of the distribution is measured by how much smaller the 10th percentile wage is than the 50th percentile wage. A larger percentage difference indicates greater wage dispersion.

whereas the 10th percentile rate was \$8.00 (\$16,000 annually). Between 1979 and 2009, the median wage rate of women increased substantially, rising by 37 percent after adjusting for inflation (see the right panel of Figure 1). The 90th percentile wage grew even more rapidly, by 70 percent, whereas the 10th percentile wage grew much more slowly, by only 8 percent.

To put those wage growth rates in context, real output per worker in the United States rose by 59 percent between 1979 and 2009. Several factors account for the large difference between the growth in output per worker and the growth in the median wage. For instance, workers' compensation as a share of national income fell by about 3 percentage points over the period, declining from 67 percent to 64 percent. That decline implies that owners of capital (such as stockholders and other owners of businesses) earned an increasing share of the income generated in the United States over that period.

At the same relative places in their wage distributions, wage rates of women were lower than those of men. The median wage rate of women in 2009 was about 82 percent of the rate for men; at the 90th and 10th percentiles, the wage rates of women were 78 percent and 90 percent, respectively, of those of men. The gaps between men's and women's wages at the median and at the 90th percentile narrowed appreciably between 1979 and 2009, whereas the smaller gap at the 10th percentile did not change much.

**Changes in the Upper Half of the Distribution.**

Dispersion in the upper half of the wage distribution, as measured by the difference between the 90th and 50th percentiles of wage rates, increased throughout the 1979–2009 period for men and women (see Table 1 and Figure 2 on page 7).

For men, the 90th percentile wage rose substantially faster than the median wage between 1979 and 2009.<sup>6</sup> Consequently, dispersion in the upper half of the wage distribution increased significantly: In 1979, wages at the 90th percentile were 80 percent higher than wages at the median; by 2009, the difference had reached 132 percent.

Among women, as among men, growth in wages near the top of the distribution far outstripped growth in the middle. The difference between the 90th and 50th percentiles of women's wage rates climbed from 79 percent in 1979 to 122 percent in 2009, roughly matching the increase in the dispersion of men's wages.

**Changes in the Lower Half of the Distribution.**

Dispersion in the lower half of the wage distribution increased in the early 1980s for both men and women. After the early 1980s, the dispersion in men's wages returned to its prior level, and the dispersion in women's wages leveled off.

The 10th percentile wage of men declined between 1979 and 1986 and then rose again; it was the same in 1999 as in 1979, and it moved up a little more thereafter. Compared with the median wage of men, the 10th percentile wage was 50 percent lower in 1979 and fell to 56 percent lower in 1986. By 1989, the 10th percentile wage had

6. Table A-1 (in Appendix A) shows data for each year between 1979 and 2009.

**Table 1.****Hourly Wages at Selected Percentiles and in Selected Years for Men and Women Ages 16 to 64**

(2009 dollars)

	Percentile			Percentage Difference	
	10th	50th	90th	10th vs. 50th	90th vs. 50th
<b>Men</b>					
1979	8.50	17.10	30.70	-50	80
1986	7.60	17.20	33.60	-56	95
1989	7.80	16.10	32.30	-52	101
1999	8.50	17.30	37.00	-51	114
2007	8.70	17.80	40.50	-51	128
2009	8.90	18.50	43.00	-52	132
<b>Women</b>					
1979	7.40	11.00	19.70	-33	79
1986	6.30	11.90	22.50	-47	89
1989	6.30	12.00	23.80	-48	98
1999	7.50	13.50	28.60	-44	112
2007	7.80	14.70	32.60	-47	122
2009	8.00	15.10	33.50	-47	122

Source: Congressional Budget Office based on monthly data from Census Bureau, Current Population Survey, Outgoing Rotation Groups, 1979 to 2009.

Note: Wages are converted to 2009 dollars using the personal consumption expenditure price index and rounded to the nearest 10 cents, and a worker's wage is weighted by his or her hours worked. Data are shown for 1979, 1989, 1999, and 2007 because those years are all close to business-cycle peaks. Data for 1986 are shown to highlight important trends that shifted in the mid-1980s, and data for 2009 are shown because they are the most recent available. See Table A-1 for data for all years between 1979 and 2009.

nearly returned to its 1979 level relative to the median and remained there through 2009.

The 10th percentile wage of women followed a similar pattern to that of men, declining between 1979 and 1986 and then rising again so that it was about the same in 1999 as in 1979 and increased further thereafter. The 10th percentile wage of women was 33 percent below the median wage in 1979, but it fell to 47 percent below the median in 1986. Unlike the gap between the 10th percentile and median wage for men, however, the gap for women remained relatively constant in percentage terms after 1986.

### Wage Rates and Educational Attainment

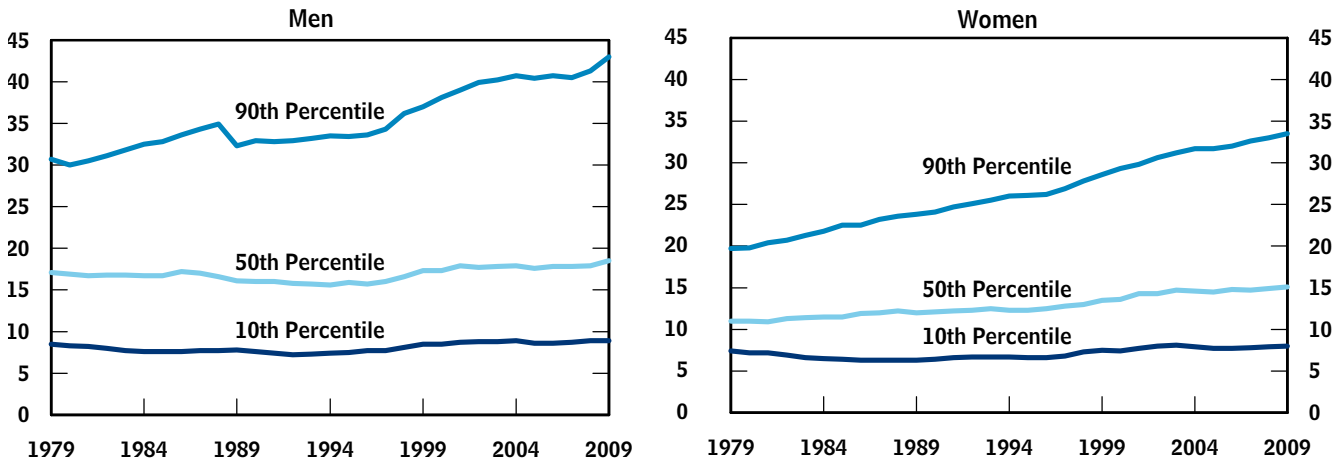
The most important source of widening dispersion in the top half of the wage distribution between 1979 and 2009 was growth in the wages of college graduates compared with those of high school graduates.<sup>7</sup> For men and women alike, the difference between the wages received by college and high school graduates increased significantly during each of the past three decades. However,

the rate of increase lessened over time, with the difference growing most during the 1980s, less during the 1990s,

7. See David Autor, Lawrence Katz, and Melissa Kearney, *Residual Wage Inequality: The Role of Composition and Prices*, Working Paper 11628 (Cambridge, Mass.: National Bureau of Economic Research, September 2005). Autor, Katz, and Kearney conclude, "The steady rise of upper tail inequality since the late 1970s appears almost entirely explained by ongoing between-group price changes (particularly increasing wage differentials by education) and residual price changes." Also see Thomas Lemieux, "Post-secondary Education and Increasing Wage Inequality," *American Economic Review*, vol. 96, no. 2 (May 2006), pp. 195–199. Lemieux's calculations allow the quantity of skill to vary across and within education groups; when the price of skill increases, inequality rises both within and across education groups. He concludes that most of the increase in wage inequality between 1973 and 2005 resulted from the dramatic increase in the return to postsecondary education. For a decomposition of wage inequality, see Autor, Katz, and Kearney, *Residual Wage Inequality*. For a review of the earlier research, see Lawrence F. Katz and David H. Autor, "Changes in the Wage Structure and Earnings Inequality," in O. Ashenfelter and D. Card, eds., *Handbook of Labor Economics*, vol. 3A (Amsterdam, The Netherlands: Elsevier Science, 1999), pp. 1463–1555.

**Figure 1.****Hourly Wages at Selected Percentiles for Men and Women Ages 16 to 64**

(2009 dollars)



Source: Congressional Budget Office based on monthly data from Census Bureau, Current Population Survey, Outgoing Rotation Groups, 1979 to 2009.

Note: Wages are converted to 2009 dollars using the personal consumption expenditure price index and rounded to the nearest 10 cents, and a worker's wage is weighted by his or her hours worked.

and even less during the 2000s. That slowing of the increase in dispersion held for both the difference between the wages of workers with bachelor's degrees and high school diplomas or GEDs and the difference between the wages of workers with graduate courses or degrees and high school diplomas or GEDs.

In 2009, the median wage for men ages 16 to 64 with bachelor's degrees was 72 percent more than the median wage for men with only high school diplomas or GEDs (see Table 2 and the left panel of Figure 3 on page 9). That difference was nearly triple the 27 percent difference in 1979. The median wage of men with graduate courses or degrees was 126 percent more than that of men with a high school education in 2009, up from 41 percent more in 1979.

The differences in wages for women across education groups show a similar pattern. In 2009, the median wage of women ages 16 to 64 with bachelor's degrees was 68 percent higher than that of women with high school diplomas or GEDs, almost double the 36 percent difference in 1979 (see the right panel of Figure 3).

### Explaining Changes in Wages Over Time

Market forces were the principal drivers of the changes in the wage distribution during the 1979–2009 period. In particular, changes in the demand for and supply of workers with different levels of skill and education account for most of the widening gap between the wages of college graduates and high school graduates. The post-World War II period saw steady growth in demand for college graduates that put upward pressure on their relative wages. For most of that period, growth in the supply of college graduates offset that pressure, but beginning in the early 1980s, that growth slowed because people entering the workforce did not have significantly more education than those retiring and leaving the workforce. Institutional factors, such as changes in the minimum wage and unionization, also contributed to changes in the wage distribution, particularly during the 1980s.

### Factors Affecting the Demand for Skilled Workers

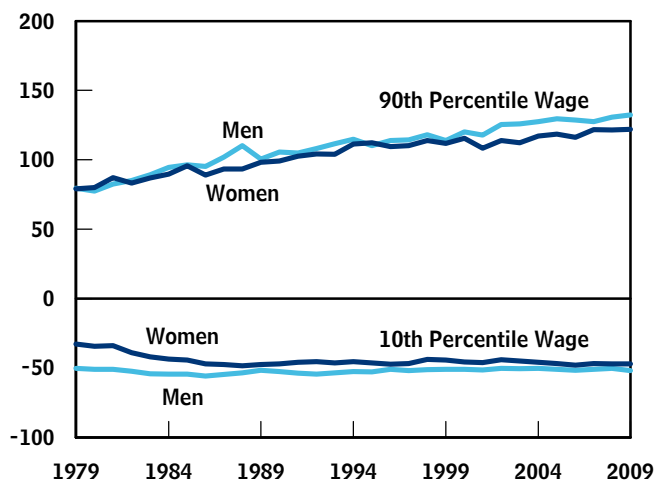
Technological innovations and related organizational changes are probably responsible for most of the increased demand for workers with more education and skills. The steadily increasing demand for more-educated workers relative to those with less education that occurred through much of the 20th century is commonly referred



**Figure 2.**

## Differences Between Selected Percentiles of Hourly Wages Among Men and Women Ages 16 to 64

(Percentage difference from the median wage)



Source: Congressional Budget Office based on monthly data from Census Bureau, Current Population Survey, Outgoing Rotation Groups, 1979 to 2009.

Note: A worker's wage is weighted by his or her hours worked.

to as skill-biased technological change. Since the late 1980s, skill-biased technological change has been embodied to an important extent in advances in the microchip and related technologies. Those technologies decreased the relative demand for workers doing routine cognitive work typical of “middle-skilled” jobs and increased the relative demand for highly skilled workers doing more complex analysis, evaluation, and decisionmaking. (Although skill is difficult to measure directly, it is strongly related to education because education imparts skills and because more-skilled individuals may be more likely to obtain more education.)

Changing patterns of international trade may also have increased the relative demand for workers with more education by changing the goods and services that the United States produces domestically. However, the evidence on the effect of globalization on the wage distribution is inconclusive.

**Skill-Biased Technological Change.** Skill-biased technological change arises from innovations that favor more-educated workers with the skills to use new technology productively relative to less-educated and less-skilled

workers.<sup>8</sup> Numerous researchers conclude that, on balance, the technological changes of the past six decades—and perhaps the entire past century—increased employers' demand for workers with higher skills and more education. That increase (along with changes in the supply of workers with more education, discussed later) generated substantial changes in the relative wages of college and high school graduates. Specifically, in the 1980s, technological changes caused increases in demand for higher-skilled relative to lower-skilled workers; in the 1990s through 2000s, technological changes caused increases in demand for higher- and lower-skilled workers relative to middle-skilled workers.

Over the past century, new technologies have had a profound impact on how Americans live and work.<sup>9</sup> During the first few decades of the 1900s, the development of batch production processes and the electrification of homes and factories led to the widespread use of many new products, such as automobiles, home appliances, processed foods, and chemicals. Transportation advances in the 1950s and 1960s allowed for faster, safer, and lower-cost travel, which opened up many new economic opportunities. During the past few decades, a surge of new information technologies making use of the microchip have fundamentally changed the economy. Personal computers, laser printers, e-mail, Web sites, search engines, laptops, cell phones, bar codes, touch screens, and online commerce are some of the technologies that have matured in recent decades and dramatically affected Americans' lives and work.

In particular, new technologies have created tools to aid workers, changed the production of goods and services, altered the organization of work, and improved connections between producers and consumers—all of which have affected the skills that firms need in their employees. As just one example, the development and widening use of factory robots have shifted demand away from production workers and toward positions requiring greater skills. Although the technologies used in firms and the methods

8. Not all technological changes are skill biased. For example, the shift from production by craftsmen and artisans in the 19th century to production in factories with production lines (as with the Ford Model T) in the 20th century was not skill biased because it increased the relative demand for unskilled workers. See Claudia Goldin and Lawrence F. Katz, *The Race Between Education and Technology* (Cambridge, Mass.: Belknap Press, 2008).

9. Ibid.

**Table 2.****Median Hourly Wages of Men and Women Ages 16 to 64, by Educational Attainment**

	Less Than High School	High School Diploma or GED	Some College or Associate's Degree	Bachelor's Degree	Graduate Courses or Degree
<b>Median Hourly Wage (2009 dollars)</b>					
<i>Men</i>					
1979	13.30	16.80	17.70	21.40	23.70
1989	11.10	14.90	16.20	22.50	27.00
1999	10.10	15.00	17.20	24.70	31.20
2009	11.10	15.20	17.50	26.20	34.30
<i>Women</i>					
1979	8.60	10.60	11.60	14.40	17.60
1989	7.90	10.80	12.60	16.80	20.90
1999	8.20	11.40	13.20	19.20	24.90
2009	9.00	12.10	14.00	20.30	26.60
<b>Percentage Difference in Median Hourly Wage Relative to That of High School Graduates</b>					
<i>Men</i>					
1979	-21	n.a.	5	27	41
1989	-26	n.a.	9	51	81
1999	-33	n.a.	15	65	108
2009	-27	n.a.	15	72	126
<i>Women</i>					
1979	-19	n.a.	9	36	66
1989	-27	n.a.	17	56	94
1999	-28	n.a.	16	68	118
2009	-26	n.a.	16	68	120

Source: Congressional Budget Office based on monthly data from Census Bureau, Current Population Survey, Outgoing Rotation Groups, 1979 to 2009.

Notes: The survey question on educational attainment changed in 1992 to put more emphasis on credentials obtained rather than years completed. Wages are converted to 2009 dollars using the personal consumption expenditure price index and rounded to the nearest 10 cents, and a worker's wage is weighted by his or her hours worked.

n.a. = not applicable.

they used to organize their work are extremely diverse, the collective effect of new technologies over recent decades has been to increase the relative demand for skilled workers.<sup>10</sup>

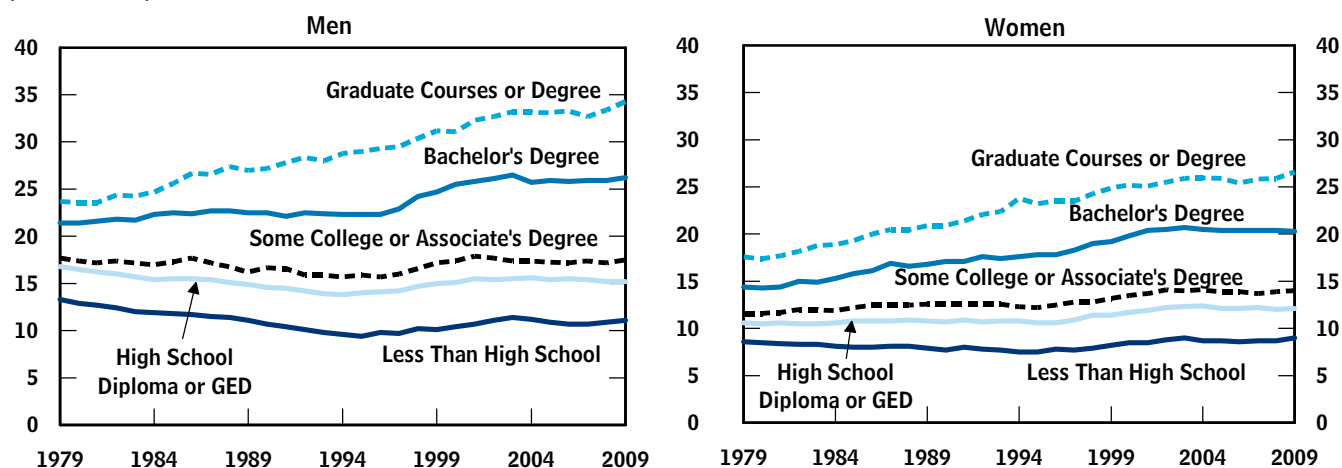
The effects of those developments can be seen not only in the higher relative wages of more-educated workers but also in increased employment in occupations demanding higher levels of education. One way to gauge employers' demand for higher levels of education is to group

occupations by their workers' average education. Some occupations are composed of workers whose average education is above that of the workforce as a whole; other occupations have workers whose average education is close to or even below that level. Between 1980 and 1990, before the surge in information technologies, the share of total employment in low-education occupations fell, while the share in average- and high-education occupations rose. That rise in the demand for education was reflected in the widening gaps in wages during that decade between workers at the 10th percentile and the

10. Ibid.

**Figure 3.****Median Hourly Wage, by Educational Attainment, for Men and Women  
Ages 16 to 64**

(2009 dollars)



Source: Congressional Budget Office based on monthly data from Census Bureau, Current Population Survey, Outgoing Rotation Groups, 1979 to 2009.

Note: Wages are converted to 2009 dollars using the personal consumption expenditure price index and rounded to the nearest 10 cents, and a worker's wage is weighted by his or her hours worked.

median as well as between workers at the 90th percentile and the median.

Since at least 1990, the microchip and related technologies have affected the demand for skilled workers in a particular way: Those technologies have increased the demand for nonroutine cognitive work relative to routine cognitive work while leaving the relative demand for manual work largely unaffected.<sup>11</sup> Specifically, new information technologies complemented nonroutine cognitive work (such as analysis, evaluation, and decisionmaking), thereby increasing demand for the highly skilled, more-

educated workers that perform those tasks. In contrast, those technologies reduced demand for routine cognitive work (such as typing and filing), thereby holding down demand for workers who perform those tasks. And the technologies had little effect on the demand for routine manual work that must be done in a specific location or that involves interacting with people; therefore, they had little impact on the demand for workers such as janitors, waiters, and home health aides.

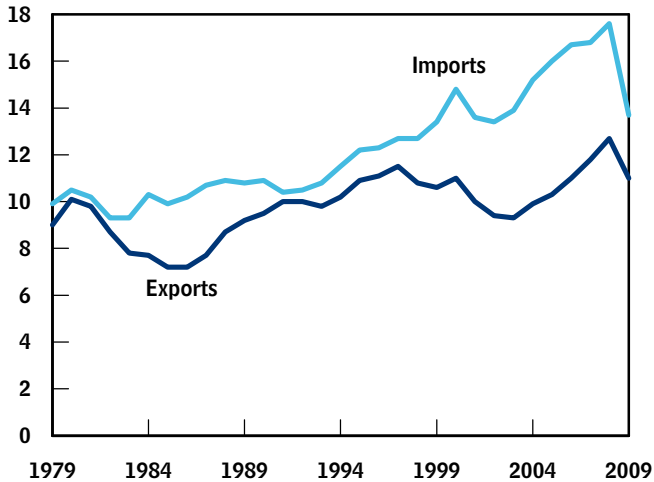
Those more recent shifts in demand led to additional changes in the distribution of employment across occupations. The share of total employment in high-education occupations (those most involved with nonroutine cognitive tasks) increased relative to the share in average-education occupations (those in which workers perform routine cognitive tasks). Furthermore, the employment share in low-education occupations (whose workers generally perform manual tasks) rose relative to the share in average-education occupations.<sup>12</sup> Among low-education occupations, the share of employment (and average

11. David Autor, Frank Levy, and Richard Murnane, "The Skill Content of Recent Technological Change: An Empirical Exploration," *Quarterly Journal of Economics*, vol. 118, no. 4 (2003), pp. 1279–1333. See also Daron Acemoglu and David Autor, *Skills, Tasks, and Technologies: Implications for Employment and Earnings*, Working Paper 16082 (Cambridge, Mass.: National Bureau of Economic Research, June 2010). For critiques of skill-biased technological change as an explanation for recent trends in wage inequality, see David Card and John E. DiNardo, "Skill-Biased Technological Change and Rising Wage Inequality: Some Problems and Puzzles," *Journal of Labor Economics*, vol. 20, no. 4 (September 2002), pp. 733–783; and Thomas Lemieux, "Increased Residual Wage Inequality: Composition Effects, Noisy Data, or Rising Demand for Skill?" *American Economic Review*, vol. 96, no. 3 (June 2006), pp. 461–497.

12. See Autor, Levy, and Murnane, "The Skill Content of Recent Technological Change"; and David Autor, *The Polarization of Job Opportunities in the U.S. Labor Market: Implications for Employment and Earnings* (Washington, D.C.: Center for American Progress and the Hamilton Project, April 2010), Figure 1.

**Figure 4.****U.S. Imports and Exports**

(Percentage of U.S. gross domestic product)



Source: Congressional Budget Office based on data from Bureau of Economic Analysis, national income and product accounts.

wages) in occupations that involve in-person service increased relative to that in production occupations.<sup>13</sup>

The rough stability of dispersion in the lower half of the wage distribution after 1990 also results from the slower growth in the demand for routine cognitive work relative to nonroutine manual work. After the surge in information technologies, the 10th percentile of wages (typical of what low-skilled workers engaged in manual but non-routine tasks earn) stopped falling relative to median wages (which are typical of what workers engaged in routine cognitive tasks earn). Meanwhile, the continued widening in the dispersion of wages between the 90th percentile and both the median and 10th percentile reflects the surge in demand for highly skilled workers engaged in nonroutine cognitive tasks.

**Globalization.** International trade has increased in importance for the U.S. economy over the past three decades. Since 1979, imports and exports alike have risen markedly as a share of the nation's economic output, especially if one looks at the trend through the business-cycle peak

in 2007 rather than into the recession in 2009 (see Figure 4). The excess of imports over exports increased from less than 1 percent of output in 1979 to 5 percent in 2007 before decreasing to 3 percent in 2009. Furthermore, imports of manufactured goods from developing countries (where wages tend to be lower than in the United States and other developed countries) have more than doubled as a share of output in the past two decades, climbing from about 2 percent in 1989 to more than 5 percent in 2006.<sup>14</sup>

Those changes probably reduced the wages of some types of workers in the United States. To the extent that U.S. consumers switched to buying goods and services produced overseas and U.S. firms switched to buying parts and services required for their businesses from overseas, the demand for U.S. labor that would have produced those goods or services declined. And, to the extent that the domestic goods and services that were replaced by imports were disproportionately produced using low-skilled workers, the demand for those workers in the United States would have fallen. In turn, the wages of those workers would have declined relative to those of high-wage workers engaged in the production of goods and services that were not being replaced by imports.

Globalization and computerization often have similar effects on the demand for workers. Many of the tasks that are amenable to computerization because the steps to complete them can be readily described in a step-by-step process are also amenable to being sent abroad to be completed by lower-wage workers, despite the disadvantages of distance. In addition, computerization may be one factor leading to increased globalization of labor markets. Advances in long-distance communications and reductions in its cost lessen the disadvantages of sending work abroad to be completed. Consequently, not only can computerization directly affect the demand for workers across occupations, it can also affect it indirectly by increasing purchases of services from abroad.

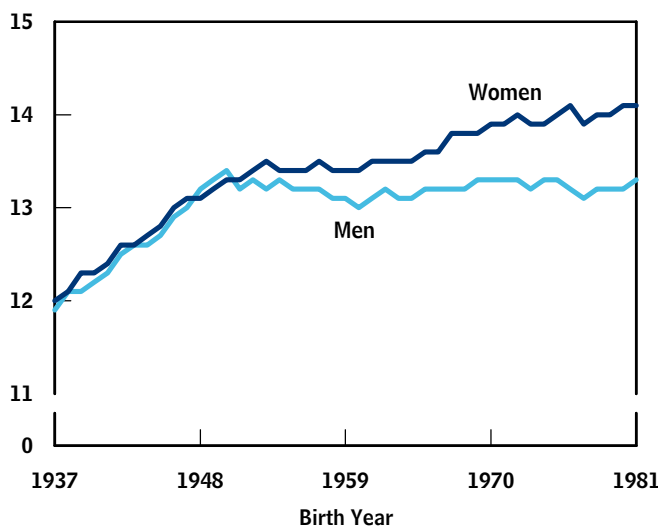
13. David H. Autor and David Dorn, *Inequality and Specialization: The Growth of Low-Skill Service Jobs in the United States*, Working Paper 15150 (Cambridge, Mass.: National Bureau of Economic Research, July 2009), Table 1.

14. See Paul Krugman, "Trade and Wages, Reconsidered," *Brookings Papers on Economic Activity*, vol. 2008, no. 1 (Spring 2008), Figures 1 and 3, pp. 103–154. Most of that growth resulted from increased trade with China and Mexico, where wages of manufacturing workers average just 4 percent and 13 percent, respectively, of the wages of manufacturing workers in the United States. See Department of Labor, Bureau of Labor Statistics, "International Comparisons of Hourly Compensation Costs in Manufacturing, 2008" (news release, August 26, 2010), [www.bls.gov/news.release/pdf/ichcc.pdf](http://www.bls.gov/news.release/pdf/ichcc.pdf).

**Figure 5.**

### Educational Attainment at Ages 25 to 29 for Working Men and Women Born Between 1937 and 1981

(Average years of education completed)



Source: Congressional Budget Office based on data from Census Bureau, March Current Population Survey, 1962 to 2010.

Note: The value for a particular birth year is based on information from five years. For example, for people born in 1980, the value shown represents the average years of education completed for people age 25 in 2005 through those age 29 in 2009.

However, research on the importance of globalization in explaining changes in the wage distribution during the past few decades has produced mixed results. One study found that between 15 percent and 24 percent of the increase in the share of wages paid to nonproduction workers during the 1980s was associated with increased purchases by firms of products and services from overseas.<sup>15</sup> Another study concluded that although increasing trade with developing countries may have contributed to growing dispersion of wages over the 1995–2005 period, the impact was fairly small.<sup>16</sup> Yet another

15. See Robert C. Feenstra and Gordon H. Hanson, “Global Production Sharing and Rising Inequality: A Survey of Trade and Wages,” in E. Kwan Choi and James Harrigan, eds., *Handbook of International Trade: Volume 1* (Malden, Mass.: Blackwell, 2003), pp. 146–185.

16. See Robert Lawrence, *Blue Collar Blues: Is Trade to Blame for Rising U.S. Income Inequality?* (Washington, D.C.: Peterson Institute for International Economics, 2008).

analysis concluded that the impact cannot be accurately estimated using existing data, because those data do not show the amount of labor of different types that is used in the production of imported goods.<sup>17</sup>

#### Factors Affecting the Supply of Skilled Workers

Between 1979 and 2009, improvement in the educational attainment of the workforce slowed, which tended to increase the wages of more-educated workers. One factor behind that trend was a slowdown in the improvement in educational attainment of recent birth cohorts entering the workforce compared with that of earlier ones leaving the workforce. Two other factors—an influx of foreign-born workers and rising participation of women in the labor force—also affected the availability of workers with different levels of education. The influx of foreign-born workers with little education tended to put downward pressure on the wages of workers who had not completed high school, and the influx of foreign-born workers and women with college degrees tended to offset some of the upward pressure on the wages of college graduates resulting from technological change and globalization.

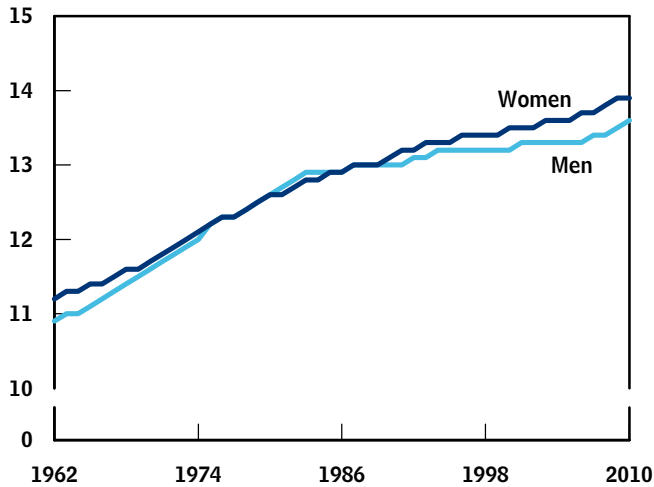
#### Slowing Growth in the Educational Attainment of

**Workers.** Educational attainment of successive birth cohorts had been rising sharply up to the cohorts born around 1950; at that point, educational attainment stopped increasing among men and increased much more slowly among women than it had earlier (see Figure 5). That change primarily reflected a slowdown in the rate of increase of college graduation. As a result, the educational attainment of young people entering the workforce increased much more slowly after about 1970 than it had before that. Despite the slowdown, the average educational attainment of the entire workforce has continued to increase because workers who are retiring have less education than those who are entering the workforce; however, that growth has been much slower since the early 1980s than it had been before then (see Figure 6). Between 1969 and 1979, the average years of education completed by workers increased by 1.0 year (from 11.5 years to 12.5 years); between 1979 and 1989, it increased by only 0.5 years; and between 1989 and 2009, it increased by just 0.4 years per decade. That slowdown in the improvement in educational attainment combined with growing demand for more-educated workers drove

17. See Krugman, “Trade and Wages, Reconsidered.”

**Figure 6.****Educational Attainment of Working Men and Women Ages 16 to 64**

(Average years of education completed)



Source: Congressional Budget Office based on data from Census Bureau, March Current Population Survey, 1962 to 2010.

the wage premium for college graduates higher—a key reason for the increasing wage dispersion in the top half of the wage distribution.<sup>18</sup>

**The Influx of Foreign-Born Workers.** Among all workers ages 16 to 64, the share of foreign-born workers jumped from 6.5 percent in 1980 to 15.5 percent in 2009.<sup>19</sup> Although that influx of foreign-born workers affected the distribution of wages, the evidence suggests that the effects have been fairly small.

Foreign-born workers in the United States have lower levels of educational attainment, on average, than their native-born counterparts. In 2009, 27 percent of foreign-born workers lacked a high school credential, compared with 6 percent of native-born workers.<sup>20</sup> The disproport-

ionate share of foreign-born workers with low levels of educational attainment exerted downward pressure on wages for U.S. workers near the bottom of the wage distribution. By one estimate, the increase in foreign-born workers reduced the wages of native-born workers without high school credentials by as much as 9 percent between 1980 and 2000 (compared with what those wages would have been without that immigration) and decreased the wages of high-school graduates by 2 percent.<sup>21</sup>

However, the increase in foreign-born labor also had broader economic effects. For example, reducing the wages of day laborers engaged in hauling and demolition lowers the cost of construction projects, thereby increasing the demand for other workers, such as delivery drivers, carpenters, electricians, and plumbers (as well as the demand for the tools and equipment used in construction). One study that tries to account for those broader changes estimates that the negative impact of foreign-born workers on the wages of native-born workers who have not completed high school drops from 9 percent to 4 percent. In addition, the estimated impact on the wages of high school graduates reverses; rather than lowering the wages of native-born high school graduates by 2 percent, the influx of foreign-born workers raises those wages by 2 percent.<sup>22</sup>

Furthermore, many foreign-born workers have high levels of educational attainment: 31 percent hold at least a bachelor's degree, just a little below the 35 percent of native-born workers who hold at least a bachelor's degree. Having a greater number of highly educated workers has offset some of the upward pressure on wages in the upper part of the wage distribution.<sup>23</sup> And just as having a greater number of less-skilled foreign-born workers in the labor force generates some demand for more highly skilled workers, having a greater number of more-skilled

18. Goldin and Katz, *The Race Between Education and Technology*, Chapter 8, pp. 287–323.

19. Because information on the foreign-born population is not available in the Current Population Surveys before 1994, tabulations in this section are based on Public Use Samples from the 1980, 1990, and 2000 censuses and the 2009 Current Population Survey. See Steven Ruggles and others, “Integrated Public Use Microdata Series: Version 5.0” [Machine-readable database] (Minneapolis: University of Minnesota, 2010).

20. Congressional Budget Office, *The Role of Immigrants in the U.S. Labor Market: An Update* (July 2010), Table 4.

21. George J. Borjas, “The Labor Demand Curve Is Downward Sloping: Reexamining the Impact of Immigration on the Labor Market,” *Quarterly Journal of Economics*, vol. 18, no. 4 (2003), pp. 1335–1374.

22. George J. Borjas, *Wage Trends Among Disadvantaged Minorities*, Working Paper 05-12 (Ann Arbor: University of Michigan, National Poverty Center, August 2005), p. 26.

23. George J. Borjas, “Immigration in High-Skill Labor Markets: The Impact of Foreign Students on the Earnings of Doctorates,” in Richard B. Freeman and Daniel L. Goroff, eds., *Science and Engineering Careers in the United States: An Analysis of Markets and Employment* (Cambridge, Mass.: National Bureau of Economic Research, June 2009), pp. 131–162.

foreign-born workers stimulates demand for other workers in the economy by creating new products and production processes.

All together, the estimated impact of foreign-born workers on wage dispersion appears to have been modest. An earlier CBO study concluded that the increasing percentage of the workforce that is foreign born had a negligible impact on wage dispersion as measured by the difference between the median and the 10th percentile.<sup>24</sup> Another study found that immigration accounted for about 5 percent of the growth in overall wage inequality between 1980 and 2000.<sup>25</sup>

**The Influx of Working Women.** One important change in the U.S. labor force over the past 30 years has been the substantial increase in the participation rate of women, which rose from 59 percent in 1979 to 69 percent in 2009 among those ages 16 to 64. Consequently, women's share of the workforce increased from 38 percent to 44 percent over that period.

The increase in the female share of the labor force over the past three decades was particularly high among college graduates: Between 1979 and 2009, the share of all college-educated workers who were women grew from 32 percent to 46 percent. Without that influx of highly educated women, the growth in the number of college graduates in the workforce would have been significantly slower than it was. The likely consequence would have been that the upward pressure on wages of college graduates would have been even greater than it was, and the wages of college graduates would have risen even more than they did.

### Institutional Factors

Although market forces were the principal drivers of changes in the wage distribution during the past 30 years, changes in the minimum legal wage and rates of unionization also played a role.

**Changes in the Federal Minimum Wage.** The extent to which minimum-wage laws influence the wage structure depends on the level of the minimum wage and how employers and workers respond to it. Particularly during

the 1980s, the falling value of the minimum wage after adjusting for inflation contributed to a decline in hourly wages at the low end of the wage distribution relative to hourly wages higher in the distribution.

An increase in the minimum wage affects the structure of wage rates in three ways:

- It directly increases the wage rate of workers previously earning less than the new minimum who remain employed;
- To the extent that employers attempt to maintain relative wage rates across workers with different levels of skill and experience, it boosts the wage rates of some workers previously earning more than the new minimum; and
- It leads to a small number of workers' losing their jobs, which results in those workers being omitted from the group used to calculate dispersion in wage rates.<sup>26</sup>

Between 1979 and 2009, the federal minimum wage was adjusted upward periodically, but between those upward adjustments its inflation-adjusted value fell as rising prices eroded its nominal value (see Figure 7). Between 1979 and 1989, the real value of the minimum wage fell by almost 30 percent.<sup>27</sup> Similarly, following a statutory increase in 1997, the minimum wage declined in real

26. The effect of the minimum wage on employment of low-wage workers, such as teenagers and those working in food service establishments, has been studied extensively. Although findings from those studies vary greatly, the weight of the evidence suggests that raising the minimum wage has a small negative effect on the employment of low-wage workers. For a review of that literature, see David Neumark and William L. Wascher, "Minimum Wages and Employment," *Foundations and Trends in Microeconomics*, vol. 3, no. 1–2 (2007), pp. 1–182.

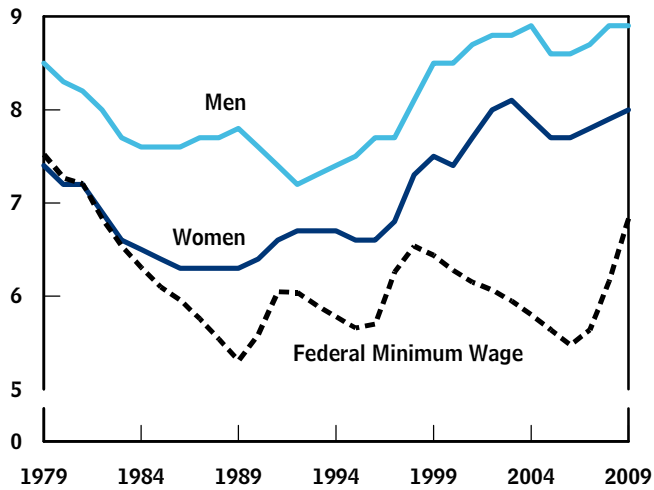
27. States also have minimum-wage laws that, in many cases, mandate wages that are higher than the federal minimum (in which case employers must comply with the higher wage). In 2007, before the federal minimum wage was increased in a series of three steps, 30 states had minimums above the federal minimum of \$5.15 per hour. By the beginning of 2010, only 14 states had minimum-wage rates above the federal hourly minimum of \$7.25 (see [www.dol.gov/whd/minwage/america.htm](http://www.dol.gov/whd/minwage/america.htm)). Also, not all employees are covered by the Fair Labor Standards Act, which establishes standards for federal minimum wages, overtime pay, record-keeping, and child labor. In late 2009, the Department of Labor estimated that about 130 million (out of 140 million) private- and public-sector workers were covered by that law (see [www.dol.gov/compliance/guide/minwage.htm](http://www.dol.gov/compliance/guide/minwage.htm)).

24. See Congressional Budget Office, *Changes in Low-Wage Labor Markets Between 1979 and 2005*, Box 3.

25. David Card, *Immigration and Inequality*, Working Paper 14683 (Cambridge, Mass.: National Bureau of Economic Research, January 2009).

**Figure 7.**  
**Hourly Wages at the 10th Percentile for Men and Women and the Federal Minimum Wage**

(2009 dollars)



Sources: Congressional Budget Office based on monthly data from Census Bureau, Current Population Survey, Outgoing Rotation Groups, 1979 to 2009; and the U.S. Department of Labor.

Note: Wages are converted to 2009 dollars using the personal consumption expenditure price index and rounded to the nearest 10 cents, and a worker's wage is weighted by his or her hours worked.

terms by almost 19 percent by 2007.<sup>28</sup> The most recent increase in the minimum wage occurred in July 2009, when it was raised to \$7.25 per hour; adjusted for inflation, the minimum wage was higher in 2009 than it had been for more than two decades but still slightly below its value in 1979.<sup>29</sup>

A key difference between the 1979–1989 period and the 1997–2007 period was the level of the minimum wage relative to the 10th percentile wage in the economy. Between 1997 and 2007, the 10th percentiles of men's and women's inflation-adjusted wages were significantly

higher than the minimum wage (see Figure 7). As a result, the minimum wage probably did not play an important role in supporting the lower end of the wage distribution during that period. In contrast, between 1979 and 1983, the 10th percentiles of men's and women's real wages were close to the federal minimum wage and declined at about the same rate (adjusted for inflation). That pattern suggests that during the early 1980s, the minimum wage may have been supporting the lower part of the wage distribution. After that point, as the real value of the minimum wage fell further, the 10th percentiles of men's and women's inflation-adjusted wages stopped declining as rapidly as the minimum wage. Research finds that the decrease in the real value of the federal minimum wage between 1979 and 1989 accounts for a significant part of the increase in the dispersion of wages between the median and the 10th percentile for men and women during that period, with the evidence being particularly strong for women.<sup>30</sup>

**Declining Union Coverage.** A decline in unionization, especially in the 1980s, contributed to increased wage dispersion for men in the upper half of the wage distribution. Unions affect the dispersion of wage rates in two principal ways. First, union contracts generally standardize wages on the basis of just a few worker characteristics and, consequently, wage dispersion among unionized workers is generally less than among similar non-unionized workers. Second, unionization generally raises the wages of union members relative to nonunion

30. See David S. Lee, "Wage Inequality in the United States During the 1980s: Rising Dispersion or Falling Minimum Wage?" *Quarterly Journal of Economics*, vol. 114, no. 3 (August 1999), pp. 997–1023. To identify the effect of federal and state minimum wages on the wage distribution, Lee uses differences across states in how binding the federal (and state) minimum wages are, as the general level of wages is higher in some states than in others. He concludes that the decline in the real value of the minimum wage between 1979 and 1989 accounts for all of the increase in the dispersion of wages between the 50th and 10th percentiles for men and women alike during the 10-year period. For a recent reanalysis that makes additional adjustments for statistical issues that Lee did not address, see David Autor, Alan Manning, and Christopher Smith, *The Contribution of the Minimum Wage to U.S. Wage Inequality Over Three Decades: A Reassessment*, Working Paper 16533 (Cambridge, Mass.: National Bureau of Economic Research, November 2010). Those adjustments reduce the estimated effects of the falling minimum wage by about half.

28. Minimum Wage Increase Act of 1996, Public Law 104-188, Sec. 2104 (August 20, 1996), 110 Stat. 1928-29.

29. Fair Minimum Wage Act of 2007, P.L. 110-28, Sec. 8102 (May 25, 2007), 121 Stat. 188-89.



members.<sup>31</sup> How that relative increase affects wage dispersion is not straightforward, however, because it depends on where the affected workers fall in the wage distribution. Some unions cover highly educated workers, such as elementary and secondary school teachers and airline pilots; others cover workers with little or no education beyond high school, such as janitors and hotel service workers.

The share of workers covered by a union contract declined sharply from 27 percent in 1979 to 20 percent in 1986; it then continued to fall, but more slowly, dropping to 14 percent in 2009. Much of the decline in unionization occurred in the private sector, especially in manufacturing and construction. For example, unions represented 38 percent of workers in manufacturing in 1979, but only 12 percent in 2009. Furthermore, manufacturing's share of employment fell from 24 percent to 11 percent over the period, which added to the decline in the share of all workers covered by a union contract.<sup>32</sup> However, among public-sector workers—such as postal workers, police officers, fire fighters, and teachers—the unionization rate remained high over the 30-year period,

just inching down from 44 percent in 1979 to 41 percent in 2009. Public-sector employees, who tend to have more education than private-sector employees, now account for half of union-covered workers, up from 30 percent in 1979. Consequently, the power of unions to lift the wages of low-skilled and middle-skilled workers has probably declined even more than would be suggested by the overall reduction in union membership.

By one estimate, the decline in unionization between 1979 and 1988 accounts for about one-third of the increase in dispersion in the upper half of the wage distribution for men during that period but none of the increase in the bottom half.<sup>33</sup> Among women, unionization is concentrated among higher-wage workers. Because unionization among women has been shown to increase differences in wages between more- and less-skilled workers, a decline in unionization tends to reduce wage dispersion.<sup>34</sup> For that reason, the decline in unionization cannot account for rising dispersion in wages among women, and, in fact, may have slowed that rise.

31. For estimates of the union wage premium in 2007, see Lawrence Mishel, Jared Bernstein, and Heidi Shierholz, *The State of Working America 2008/2009* (Ithaca, N.Y.: ILR Press), Chapter 3, Table 3.32. The effects of wages and benefits in union-negotiated contracts can spill over to firms whose workers are not represented by a union. On the one hand, nonunion firms may increase wages and benefits to nonunion workers to reduce their incentive to obtain union representation. On the other hand, higher costs may reduce employment at unionized firms and force more workers to seek work at nonunion firms, thereby reducing the pressure on those firms to increase wages and benefits.

32. See Barry T. Hirsch and David A. Macpherson, "Union Membership and Coverage Database from the Current Population Survey: Note," *Industrial and Labor Relations Review*, vol. 56, no. 2 (January 2003), pp. 349–354, [www.unionstats.com](http://www.unionstats.com).

33. See Thomas Lemieux, "The Changing Nature of Wage Inequality," *Journal of Population Economics*, vol. 21, no. 1 (January 2008), pp. 21–48. The estimates used in that analysis were eventually published in Sergio Firpo, Nicole Fortin, and Thomas Lemieux, "Unconditional Quantile Regressions," *Econometrica*, vol. 77, no. 3 (May 2009), pp. 953–973.

34. David Card, Thomas Lemieux, and W. Craig Riddell, "Unions and Wage Inequality," *Journal of Labor Research*, vol. 25, no. 4 (Fall 2004), pp. 519–562.



## Data Used in This Analysis

**T**his study used monthly data from the Current Population Survey (CPS) to examine the level and distribution of hourly wages between 1979 and 2009.<sup>1</sup> In particular, the analysis focused on the one-quarter of the sample in each month called the “outgoing rotation group.” Unlike other respondents in the survey, that group was asked for their hourly wage (if they were paid by the hour) and their usual weekly earnings and hours of work (if they were not). About 60 percent of the workers, on average over those years, were paid on an hourly basis. For the other workers, the Congressional Budget Office (CBO) calculated the hourly wage rate as their usual weekly earnings divided by their usual number of hours worked per week. If the respondent indicated the number varied, then the number of hours worked the previous week was used instead. Self-employed people were excluded from the analysis because the division of their earnings between their work and their investment in the business was not known. Unpaid workers in family businesses also were excluded because presumably they were compensated in other ways. Data for the 12 months of a calendar year were combined to generate average annual estimates.

Hourly wages in this study were converted to 2009 dollars using the personal consumption expenditure price index (PCEPI) for the particular month in which the wage was reported. The PCEPI is constructed by the Bureau of Economic Analysis as part of its national income and product accounts. Unlike the better-known

consumer price index (CPI), the PCEPI fully accounts for the fact that consumers adjust their spending patterns as some prices change relative to other prices.<sup>2</sup>

The hourly wages in this study were calculated for all wage and salary workers between the ages of 16 and 64.<sup>3</sup> The statistics were weighted by the number of hours worked per week, so wages paid for part-time work influenced the statistics less than wages paid for full-time work.<sup>4</sup> In particular, a worker’s wage was represented in the distribution of wages in proportion to the number of hours he or she worked. Consequently, at the 50th percentile, for example, the percentage of hourly wages below the value shown among all hours worked was 50 percent.

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1. The CPS is conducted by the Census Bureau for the Bureau of Labor Statistics. In 1994, the Census Bureau adopted computer-assisted interview methods to collect data. Any substantial change in methodology (such as that one) has the potential of creating an artificial jump in a series of data over time. In this case, however, any impact on wages and wage dispersion were small relative to the overall trends. (See Table A-1.) For a bibliography of studies aimed at understanding the effects of the changeover, see [www.bls.gov/osmr/cps.catalog.htm](http://www.bls.gov/osmr/cps.catalog.htm).

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2. The average annual inflation rate over the 1979–2009 period was 3.2 percent as measured by the PCEPI and 3.4 percent as measured by the CPI (the version based on all items in the typical market basket of goods and services consumed by all urban consumers during a base period). See Congressional Budget Office, *Using a Different Measure of Inflation for Indexing Federal Programs and the Tax Code* (January 2010), for a more detailed discussion of alternative measures of inflation.

3. The information on hourly wages and weekly earnings was not available for some respondents. (One reason was that some respondents answered on behalf of other members in the household and may not have had that information.) For those respondents, the Census Bureau filled in the missing information using comparable information from other respondents with similar characteristics.

4. Part-time workers generally are paid less per hour than full-time workers who otherwise have similar skills and do similar work. In 2002, the average part-time wage was 14 percent less than the average full-time wage after accounting for age (as a proxy for experience), education, and occupation. The reason for that difference may be that each worker imposes certain costs on an employer related to hiring, training, insurance, bookkeeping, and fringe benefits. The employer, in effect, deducts those costs from the worker’s pay. For a part-time worker, there are fewer hours over which to distribute those deductions, so the worker is paid less per hour.

**Table A-1.****Hourly Wages Between 1979 and 2009 at Selected Percentiles for Men and Women Ages 16 to 64**

(2009 dollars)

	Percentile			Percentage Difference	
	10th	50th	90th	10th vs. 50th	90th vs. 50th
<b>Men</b>					
1979	8.50	17.10	30.70	-50	80
1980	8.30	16.90	30.00	-51	78
1981	8.20	16.70	30.50	-51	83
1982	8.00	16.80	31.10	-52	85
1983	7.70	16.80	31.80	-54	89
1984	7.60	16.70	32.50	-54	95
1985	7.60	16.70	32.80	-54	96
1986	7.60	17.20	33.60	-56	95
1987	7.70	17.00	34.30	-55	102
1988	7.70	16.60	34.90	-54	110
1989	7.80	16.10	32.30	-52	101
1990	7.60	16.00	32.90	-53	106
1991	7.40	16.00	32.80	-54	105
1992	7.20	15.80	32.90	-54	108
1993	7.30	15.70	33.20	-54	111
1994	7.40	15.60	33.50	-53	115
1995	7.50	15.90	33.40	-53	110
1996	7.70	15.70	33.60	-51	114
1997	7.70	16.00	34.30	-52	114
1998	8.10	16.60	36.20	-51	118
1999	8.50	17.30	37.00	-51	114
2000	8.50	17.30	38.10	-51	120
2001	8.70	17.90	39.00	-51	118
2002	8.80	17.70	39.90	-50	125
2003	8.80	17.80	40.20	-51	126
2004	8.90	17.90	40.70	-50	127
2005	8.60	17.60	40.40	-51	130
2006	8.60	17.80	40.70	-52	129
2007	8.70	17.80	40.50	-51	128
2008	8.90	17.90	41.30	-50	131
2009	8.90	18.50	43.00	-52	132

Continued

The CPS does not report the value of very high hourly wages or weekly earnings but instead reports particular maximum values for each, which were adjusted upward in 1989 and 1998. The percentage of affected workers was small, and the maximum value for reported hourly wages was well above the 90th percentile wage in all years. When hourly wages must be computed on the basis of usual weekly earnings and hours of work, however, the computed hourly wage may fall below the 90th percentile, even if the weekly earnings are at the maximum

value, because the hours worked may be very high. To reduce systematic underestimation of wages at the 90th percentile, CBO followed the convention of multiplying earnings set at the maximum value by 1.5.<sup>5</sup>

5. Again, the share of affected workers was small: The share of male workers whose earnings were above the so-called top-coded levels was generally less than 2 percent and always less than 5 percent. The percentage of female workers affected by that top-coding was even smaller.

Table A-1.

Continued

### Hourly Wages Between 1979 and 2009 at Selected Percentiles for Men and Women Ages 16 to 64

(2009 dollars)

	Percentile			Percentage Difference	
	10th	50th	90th	10th vs. 50th	90th vs. 50th
	<b>Women</b>				
1979	7.40	11.00	19.70	-33	79
1980	7.20	11.00	19.80	-35	80
1981	7.20	10.90	20.40	-34	87
1982	6.90	11.30	20.70	-39	83
1983	6.60	11.40	21.30	-42	87
1984	6.50	11.50	21.80	-43	90
1985	6.40	11.50	22.50	-44	96
1986	6.30	11.90	22.50	-47	89
1987	6.30	12.00	23.20	-48	93
1988	6.30	12.20	23.60	-48	93
1989	6.30	12.00	23.80	-48	98
1990	6.40	12.10	24.10	-47	99
1991	6.60	12.20	24.70	-46	102
1992	6.70	12.30	25.10	-46	104
1993	6.70	12.50	25.50	-46	104
1994	6.70	12.30	26.00	-46	111
1995	6.60	12.30	26.10	-46	112
1996	6.60	12.50	26.20	-47	110
1997	6.80	12.80	26.90	-47	110
1998	7.30	13.00	27.80	-44	114
1999	7.50	13.50	28.60	-44	112
2000	7.40	13.60	29.30	-46	115
2001	7.70	14.30	29.80	-46	108
2002	8.00	14.30	30.60	-44	114
2003	8.10	14.70	31.20	-45	112
2004	7.90	14.60	31.70	-46	117
2005	7.70	14.50	31.70	-47	119
2006	7.70	14.80	32.00	-48	116
2007	7.80	14.70	32.60	-47	122
2008	7.90	14.90	33.00	-47	121
2009	8.00	15.10	33.50	-47	122

Source: Congressional Budget Office based on monthly data from Census Bureau, Current Population Survey, Outgoing Rotation Groups, 1979 to 2009.

Note: Wages are converted to 2009 dollars using the personal consumption expenditure price index and rounded to the nearest 10 cents, and a worker's wage is weighted by his or her hours worked.

To the extent that the procedure overstates earnings, the 90th percentile may be overestimated. That may account for the noticeable drop in the 90th percentile wage among men between 1988 and 1989 (see Table A-1). Conversely, to the extent that the procedure understates earnings, the 90th percentile may be underestimated, and that may account for the noticeable rise in the 90th percentile wage among men between 1997 and 1998.

Finally, when dividing usual weekly earnings by usual hours worked, the result was sometimes an implausibly low value for the hourly wage. Nonetheless, those values were included in the analysis because there were too few to affect the 10th percentile of hourly wages.<sup>6</sup>

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6. Errors in reporting are likely to occur in all surveys. Some errors (such as very low hourly wages) can be more easily identified than others (such as very high hourly wages). So as not to be biased in either direction, CBO's approach was to use all of the data.

## Additional Information on Very High Earners

**F**or this analysis, the Congressional Budget Office used wage rates at the 90th percentile to represent hourly wages at the top of the distribution. Hourly wages above the 90th percentile grew faster than wage rates at the 90th percentile. For example, among men between 1989 and 2005, the 95th percentile of hourly wages increased by 30 percent compared with 22 percent growth at the 90th percentile (see Table B-1).

The range of possible causes for what may have driven pay at the 90th percentile is more settled than it is for pay at the 95th or 99th percentiles. In addition to the factors leading to rapid wage growth for high earners discussed earlier, causes of more rapid wage growth among very high earners include the following:

- Substantial reductions in top marginal income tax rates in 1982 and 1988, which increased the after-tax benefit of receiving a higher wage;
- Growth in the size of the largest firms, which increased the consequences of their top managers' decisions, leading to higher compensation for those managers;

- Increases in the ability of top managers to extract high pay from their boards of directors, especially during the booming economy of the 1990s; and
- Increasing returns to “superstars” driven by advances in media and communication technologies.<sup>1</sup>

The dramatic increase in top wages seen in the United States (especially top executive compensation) was not seen in continental Europe or Japan. Changes in pay-setting institutions (such as unions) and social norms may have removed some implicit barriers to higher wages in the United States but not in other countries.<sup>2</sup>

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1. See Frank Levy and Peter Temin, *Inequality and Institutions in 20th Century America*, Working Paper 13106 (Cambridge, Mass.: National Bureau of Economic Research, May 2007); and Lucian Arye Bebchuk and Yaniv Grinstein, “The Growth of Executive Pay,” *Oxford Review of Economic Policy*, vol. 21, no. 2 (Summer 2005), pp. 283–303.
  2. See Thomas Piketty and Emmanuel Saez, “Income Inequality in the United States, 1913–1998,” *Quarterly Journal of Economics*, vol. 118, no. 1 (February 2003), pp. 1–39; and Piketty and Saez, “The Evolution of Top Incomes: A Historical and International Perspective,” *American Economic Review*, vol. 96, no. 2 (May 2006), pp. 200–205.

**Table B-1.**

**Growth in Wages and Earnings for High-Earning Men and Women Ages 25 to 54**

(2009 dollars)

	Hourly Wages		Weekly Earnings		Annual Earnings		
	90th Percentile	95th Percentile	90th Percentile	95th Percentile	90th Percentile	95th Percentile	99th Percentile
<b>Men</b>							
1989	33.90	40.80	1,550	1,880	76,900	99,400	213,700
2005	41.50	52.90	1,860	2,340	91,500	123,400	278,100
Percentage Change	22.4	29.7	20.0	24.5	19.0	24.1	30.1
<b>Women</b>							
1989	25.10	30.20	1,000	1,230	48,000	57,900	86,800
2005	33.00	41.50	1,330	1,680	62,200	79,400	139,100
Percentage Change	31.5	37.4	33.0	36.6	29.6	37.1	60.3

Sources: Congressional Budget Office based on monthly data from Census Bureau, Current Population Survey, Outgoing Rotation Groups, 1989 and 2005; and Congressional Budget Office, *Changes in the Distribution of Workers' Annual Earnings Between 1979 and 2007* (October 2009), Table 3.

Note: Wages are converted to 2009 dollars using the personal consumption expenditure price index and rounded to the nearest 10 cents, and a worker's wage is weighted by his or her hours worked.





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